

**FIELD EVALUATION OF TWO HOMS MOSQUITO REPELLENTS TO  
REPEL MOSQUITOES IN SOUTHERN ONTARIO, 2006**

**FINAL REPORT**

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by

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## INTRODUCTION

The purpose of this study was to assess, under field conditions, the efficacy of two HOMS mosquito repellents to protect humans for 4 and 6 hours post-application against various mosquito species in southern Ontario. The two HOMS products were Bio Block (known as Bite Blocker Xtreme in the U.S.; soybean oil, concentration unknown) and BioUD8 Spray (7.75% undecanone). The protection provided by the products was compared to that provided by Deep Woods OFF! (30% deet).

## MATERIALS AND METHODS

### Site

The study was conducted in a meadow bordering a large mixed deciduous/coniferous woodlot (e.g. maples, poplars, birch, tamarack, white cedar, and white pine are predominant species) with secondary growth under the canopy in a rural area four km south of the southern city limit of Guelph, Ontario. Adjacent to the study area was a cattail marsh (>four hectares) approximately 30 meters from the center of the study area, which is a source of *Aedes* and *Anopheles* mosquito species and the mosquito *Coquillettidia perturbans*. Previous unpublished studies have shown the site to provide sufficient numbers of adult mosquitoes for repellent evaluations. The evaluation took place on the evenings of July 24, 25, 26, 31, and August 1, 2006.

### Product Designations

HOMS Bio Block (Bite Blocker Xtreme) = **SXE**

HOMS BioUD8 Spray = **BUD**

Deep Woods OFF! = **DW**

### Repellency Evaluation

Eight subjects and a supervisor were used in this evaluation. To adjust for size differences among subjects, the surface area of the forearms (wrist to elbow) of each subject was measured and surface area was calculated. The product was applied evenly to the forearms of each subject using latex gloves at a rate of 1.0 ml per 600 cm<sup>2</sup> of forearm. During each day of the evaluation, each subject applied one product 3.5 or 5.5 hours before the start of the 30 minute evaluation. Therefore each night all products were evaluated

for two duration times. Each night two subjects were non-treated and served as controls. Biting counts were performed over a 30 minute period and therefore the duration of protection that was measured was 4.0 and 6.0 hours. Hence during the five-evening study, the products were evaluated for each application time, on each subject at least once for a total of five replications for all products and both duration times.

Subjects dressed in identical green overalls, head nets and white cotton gloves. The eight subjects were randomly assigned to one of eight positions on a grid located within the study site. All grid positions were at least 10 m from each other. Biting counts were initiated just prior to dusk ( $\approx 20:30$  h) to correspond with peak mosquito biting activity and consisted of 8, 3.5-minute biting counts. During each biting count, subjects aspirated all mosquitoes landing and probing on two exposed forearms. Mosquitoes were aspirated into 150 ml clear plastic vials. Following the biting count, the subjects recorded the number of mosquitoes captured. Subjects rotated to the next position on the grid within 17 seconds when the next 3.5-minute biting count began. In this manner, each subject was at each grid position once each night and the duration of exposure was 30 minutes.

Ambient air temperature, relative humidity and wind speed within the study site were measured at the start and end of biting counts each evening. Biting counts were not conducted on evenings when air temperature was below  $10^{\circ}\text{C}$  or when strong winds ( $\geq 25$  kph) or rain occurred because these conditions limit mosquito host-seeking activity.

### **Data Analysis**

Percent repellency provided by the product was calculated using the formula:  $((\text{number of mosquitoes biting non-treated subjects} - \text{number biting treated subjects}) / \text{number biting non-treated subjects}) \times 100\%$ . Percent repellency was calculated for the complete 30 minute exposure period (i.e. total repellency provided after each subject had been at each of the eight grid positions) on a nightly basis.

The mean number of mosquitoes biting treated and non-treated subjects over the five-evening study was compared using analysis of variance and a Duncan's Multiple Range Test. The analyses were completed using Statistical Analysis Systems version 6.12 (SAS Institute Inc., Cary, NC).

### **Mosquito Species Composition**

Mosquitoes were randomly sampled to determine species composition. Each night mosquito vials were transferred to a freezer ( $-17^{\circ}\text{C}$ ). The following day, frozen mosquitoes were transferred to a larger vial and also on subsequent days until all five trial-nights were complete. One-hundred fifty mosquitoes were randomly selected from the larger vial (approximating 30 mosquitoes per night). Mosquitoes were

identified under a dissecting microscope using the keys of Wood, Dang and Ellis (1979).

## RESULTS

SXE, BUD and DW provided 93.9, 95.5 and 96.7% protection, respectively, at 4 hours duration (Table 1). SXE, BUD and DW provided 53.7, 95.6 and 72.2% protection, respectively, at 6 hours duration. Protection provided by SXE at 4 hours, BUD at 4 and 6 hours and DW at 4 hours was not significantly different ( $P>0.05$ ). Protection provided by SXE at 6 hours and DW at 6 hours was significantly lower than that provided by BUD at 6 hours. Protection provided by SXE and DW dropped off significantly between 4 and 6 hours duration time.

The mean air temperature during the five-evening study was 23.9 °C (range = 20.7, 27.2), the mean relative humidity was 85.5% (range = 76.0, 90.0) and the mean wind speed was 1.1 kph (range = 0, 2.5). Mosquito species composition can be found in Appendix 1.

Table 1. Mean number<sup>1,2</sup> ( $\pm$  one standard deviation) and percent reduction of mosquitoes biting human subjects<sup>3</sup> during 30 minute mosquito biting counts in field tests conducted near Guelph, Ontario, 2006.

Treatment	Hours post-application (duration time)	Mean number of mosquitoes per 3.5 minutes	Percent reduction <sup>4</sup>
Control	-	4.25 $\pm$ 3.55 <b>a</b>	-
SXE	4	0.20 $\pm$ 0.46 <b>c</b>	93.9
SXE	6	2.03 $\pm$ 2.36 <b>b</b>	53.7
BUD	4	0.16 $\pm$ 0.37 <b>c</b>	95.5
BUD	6	0.15 $\pm$ 0.53 <b>c</b>	95.6
DW	4	0.13 $\pm$ 0.33 <b>c</b>	96.7
DW	6	1.15 $\pm$ 1.55 <b>b</b>	72.2

<sup>1</sup>Values followed by different letters in the same **column** are significantly different ( $P<0.05$ ).

<sup>2</sup>Number of repetitions equalled five.

<sup>3</sup>Mean biting pressure over three nights equalled 36.4 mosquitoes per 30 minutes.

<sup>4</sup>Calculated from nightly mean numbers, not from data in column three.

## **CONCLUSIONS**

In a field test using human subjects, HOMS BioUD8 Spray provided over 95% protection from blood-seeking mosquitoes after 4 and 6 hours post-application of product. HOMS Bio Block (Bite Blocker Xtreme) provided approximately 94% protection at 4 hours post-application. The performance of both products at 4 hours post-application was not significantly different from that provided by a 30% deet formulation. At 6 hours post-application, BioUD8 Spray provided significantly higher protection from mosquitoes than a 30% deet formulation.

## **REFERENCES**

Wood, D.M., P.T. Dang and R.A. Ellis. 1979. The mosquitoes of Canada. Part 6. The insects and arachnids of Canada. Publication 1686. Research Branch, Agriculture Canada, Ottawa. 390 pp.

## Appendix 1

### Mosquito Species Composition

Mosquito species composition for mosquitoes<sup>1</sup> collected from human subjects during 30 minute biting counts in field tests conducted near Guelph, Ontario, 2006.

Species	Number of Mosquitoes	Percent Composition
<i>Aedes vexans</i>	48	32.0
<i>Ochlerotatus euedes</i>	44	29.3
<i>Ochlerotatus stimulans</i>	23	15.3
<i>Coquillettidia perturbans</i>	12	8.0
<i>Ochlerotatus fitchii</i>	10	6.7
<i>Ochlerotatus trivittatus</i>	8	5.3
<i>Ochlerotatus excrucians</i>	3	2.0
<i>Anopheles walkeri</i>	1	0.7
<i>Culex tarsalis</i>	1	0.7

<sup>1</sup>Number of mosquitoes sub-sampled from pooled mosquitoes equalled 150, representing 30 per night from the 5-night trial.